NOTES AND LITERATURE

SCIENTIFIC EXHIBITS AT THE SEVENTH INTERNATIONAL ZOOLOGICAL CONGRESS

From the 19th to the 24th of August, American scientists were privileged to entertain the delegates and members of the International Zoological Congress at the Harvard Medical School, in Boston. The congress met in ten sections, and its program announced the titles of three hundred papers. The scientific exhibits, which were of unusual interest, are briefly described in the following paragraphs.

Paleontology.— Professor A. W. Grabau of Columbia University exhibited five series of spirifers of the *S. mucronatus* type, to show the gradual evolution of five species along parallel lines. The most primitive and oldest forms, from the middle Devonian (lower Hamilton), are long-winged and flat. They gave rise to the five independent series under discussion, in each of which the shells range from long-winged flat forms to those which are short-winged and round. Progress is always toward the rounded form, as shown both by the dimensions of the average shell in a given group, and by the extreme variations. Thus the most elongated shells in any group are not as long as the extreme examples from a lower horizon, but the most rounded forms surpass any which occur in the deeper strata. As shown by the lines of growth on the shells, the young stages in a given series are more elongated than the mature forms, thus resembling the adults of the preceding type. Thus the series demonstrates a gradual orthogenetic development of species, which, since similar changes occur in different localities, is presumably independent of environment.

Professor W. Patten of Dartmouth College exhibited a superb collection of Bothriolepis from the Devonian of New Brunswick. Bothriolepis is a fish-like invertebrate about ten inches long, consisting of an oblong cephalo-thorax covered with sculptured dermal plates, and a slender body free from scales but bearing dorsal and caudal fins. A strong, spine-like swimming appendage projects from either side of the thorax. Professor Patten has described and figured Bothriolepis in the *Biol. Bull.*, 1904, vol. 7, p. 105–124, and the related Tremataspis in the *Amer. Nat.*, 1903, vol. 37, p. 223–242.

Bothriolepis presumably lived in fresh or brackish water, and moved in large schools. One of the slabs showed some ten individuals headed in the same direction. Ferns and plant stems turned in the opposite direction showed that they were moving against the current. Another slab contained four specimens moving in the same direction but lying at different levels, indicating that two at least were buried in the sand when killed. The internal structure of Bothriolepis, including its stomach and the arrangement of its gills, was shown in serial sections of the fossils. In studying the ancestry of vertebrates Professor Patten desired further knowledge of Bothriolepis than could be supplied from any existing collection, and therefore he collected for himself the group of fossils exhibited. His theory of vertebrate development from arthropod prototypes was illustrated by some fifty clay models. They were designed "to show how the earlier vertebrate stages are but a further specialization of the later stages of an arachnid. The models show the origin of the blastopore, the unfolding of the cranial sense organs, the relation of the cranial neuromeres to the cephalothorax, the origin of concrescence, the derivation of the operculum and branchial chambers, the lateral fold, visceral arches, and the union of the anterior visceral arches on the haemal side to form the premaxillae, maxillae, and mandibles." One series of models illustrated the relation between echinoderm larvae and arthropod half-embryos; another series showed similarities in the mode of attachment of the larvae of cirripeds, echinoderms, and vertebrates; and a third presented a suggestive comparison of the brains of the scorpion, horse shoe crab, and primitive vertebrate.

Dr. C. R. Eastman of Harvard University showed specimens of the head shields of lung fishes, so that the well known Scottish Devonian form could be compared with the less known Canadian Scaumenacia, and also with existing lung fishes.

Mr. C. H. S. Sternberg of Lawrence, Kansas, who has collected fossils for forty years, exhibited some tortoises from the Cretaceous "Red Chalk" of Kansas, together with a specimen of *Hesperornis regalis*. The latter does not include the skull, but the cervical vertebrae were found, and show that the bird had a longer neck than some have supposed. The skeleton of the feet and legs is complete and the pelvis is well preserved. The divergent position of the legs is similar to that seen in divers and loons. Mr. Sternberg is about to publish a popular account of his experiences as a collector, entitled "The Life of a Fossil Hunter," for which Professor H. F. Osborn has written an introduction.

Zoology.— Dr. C. F. Rousselet of London exhibited fifteen slides of rotifers. They were remarkably fine, since by a special method the animals had been preserved in an extended condition. They were killed in a $\frac{1}{10}\%$ aqueous solution of osmic acid, and sealed in 7% formalin on hollow ground slides. During the congress Dr. Rousselet identified fifteen species of rotifers which he obtained in one "dip" from the pond in the Public Garden.

Professor J. A. Thomson of the University of Aberdeen showed new and rare forms of corals chiefly from the Indian ocean. They included a specimen of the remarkable new genus Studeria from the littoral region of the Andaman Islands.

Miss E. R. Gregory, professor of biology at Wells College, New York, demonstrated the structure of the sand dollar, Echinarachinus.

Drs. F. B. Sumner and J. W. Underwood have studied "the seemingly protective coloration of the gastropod *Litorina palliata*" at Woods Hole, and they exhibited water color drawings, made by K. Hayashi, of the shells and the sea weed upon which they live. The shells vary from dark brown or black to bright yellow, and they may be either uniform in color or striped. The sea weed also ranges from dark brown to yellow. The snails, however, do not select appropriate backgrounds, either experimentally or in nature. Over variously painted sectors of a glass dish their distribution is purely by chance, and in nature yellow shells are found on brown weed and vice versa. As far as experiments have shown, the fish called tautog is as likely to take shells from the surroundings which they match as from others. It is possible, as has been suggested for other forms, that the pigment of the shells is the assimilated pigment of the weeds and matches them accordingly. Dr. Sumner's work is still in progress.

Professor W. C. Curtis of the University of Missouri demonstrated specimens showing the formation of segments in the tape worm *Crossobothrium laciniatum*, which occurs in the sand shark. Usually in tape worms new segments are formed near the anterior end, so that the most anterior segment is the youngest and the most posterior is the oldest. This is true of *C. laciniatum* until about 35 segments have been produced. Then, in the unsegmented region immediately behind the head, a new series appears, of which the most anterior is the oldest and the most posterior is the youngest; thus the body is segmenting from both ends toward a middle portion. When 50 anterior segments and more than 400 posterior segments have been formed the unsegmented middle portion is obliterated. After many of the posterior segments have become mature and been detached,

the neck region elongates, and a new set of segments may be produced, consisting like the first set of an anterior and a posterior group of segments. An account of this investigation was published in the *Biological Bulletin*, 1906, vol. 11, p. 202–229.

Professor R. Heymons, curator of the zoological museum in Berlin, showed several larvae of a beetle of the genus Tenebrio which had macroscopic rudiments of wings,— a pair on the mesothorax and metathorax respectively. Since the larvae were not reared, the time of the first appearance of the rudiments was not determined. It was observed that small rudiments were shed in molting but that the larger ones remained and finally expanded into the wings of the adult. External wing rudiments on larvae of insects undergoing complete metamorphosis are very rare. They have been observed in a few other coleopterous larvae (*Anthrenus varius*) and are probably "instances of premature development."

Dr. F. E. Lutz of Cold Spring Harbor exhibited specimens of the fly Drosophila, showing variations in the venation of its wings. The arrangement of the veins in wings of flies is usually quite constant. A disturbance of the normal arrangement sometimes occurs in Drosophila in nature, and by breeding selected individuals the disturbing factor has been increased. It is inherited somewhat, but not absolutely, in Mendelian fashion, and appears to be independent of environment.

Dr. S. Metalnikoff of the Imperial Academy of Science, St. Petersburg, showed sections illustrating the immunity of the moth *Galleria melonella* to the bacilli of tuberculosis. An hour and a half after injection, the bacilli were found within the blood corpuscles, and the remains of bacilli were detected in the corpuscles five days after injection. The bacilli become transformed into brown pigment. In the tissues the bacilli were found encapsulated three days after injection; a week later they were nearly all transformed into pigment. Finally the brown pigment is absorbed by the pericardial cells.

Mr. J. H. Emerton of Boston exhibited a large and well mounted collection of spiders, preserved in small vials of alcohol. The vials containing the forms and sexes of one species were attached to a large card, upon which were notes, drawings, and usually a photograph of the web. Many of the notes and drawings have been published in "The Common Spiders of the United States" (Ginn & Co., 1902),— an attractive introduction to the study of these arachnids.

Dr. A. Petrunkevitch of Short Hills, New Jersey, demonstrated the image-forming capacity of the lenses of spiders' eyes. The

integument of a *Lycosa nidicola* was removed, carrying with it the eight eyes. From the under surface of the preparation the retinae and vitreous bodies were brushed away, leaving only the lenses in position. The integument and lenses were mounted upon the stage of a microscope, beneath which a postal card was placed upon the table. With a $\frac{2}{3}$ inch objective, eight magnified inverted images of the McKinley portrait could be seen so distinctly that the surrounding inscription was legible. The vision of the spider depends, however, upon its retina and central nervous system. A preparation of the retina was exhibited to show the coarseness of the rods. Since an image which is so small that it falls upon only one rod would be perceived as a point, Dr. Petrunkevitch has calculated the distance at which a spider can possibly recognize another spider, and in other ways has studied the nature of spiders' vision.

Professor E. L. Mark of Harvard University exhibited live Amphioxus from Bermuda. They are nearly transparent creatures about two inches in length, which remain buried in the coarse shell sand with their anterior ends projecting slightly from the surface. If disturbed they dart through the water with the greatest rapidity and by a wriggling motion promptly disappear in the sand. It was noted that about the British Isles and in the Mediterranean, Amphioxus inhabits sand of a similarly coarse texture.

Professor H. F. Nachtrieb of the University of Minnesota demonstrated several features of Polyodon, the spoon-bill sturgeon. The "bill," or flat anterior prolongation of the head, contains a central cartilaginous axis and two layers of a network of bony spicules, the spicules being easily separated in potash. Nerves extend along the axis and radiate peripherally to the skin, and especially to the primitive pores. These are clusters of pits surrounded by the patches of pigment which give the bill a mottled appearance. Dissections of the bill and sections of the pores and pigment cells were shown. The variations in the lateral line were indicated in dissections and photographs, and it was noted that the lateral line extended out on the dorsal lobe of the tail nearly to its tip. It was formerly thought to end nearer the base of the tail, as in other fishes. Professor Nachtrieb is studying further the innervation of the lateral line.

Professor W. A. Locy of Northwestern University exhibited dissections of Scyllium, Trygon, Raja, and Pristiurus to show the nervus terminalis. This is a ganglionated nerve situated near the olfactory nerve and passing to the olfactory region. It was discovered by Professor Locy, and has been described in twenty-four genera of

selachians and in lung fishes. It is considered to be a primitive nerve belonging with the morphological tip of the body, which has been replaced in the higher vertebrates by the development of adjacent nerves.

Mr. C. W. Beebe of New York exhibited bird skins to show the changes in color produced by exposing a bird to excessive humidity during successive molts. The spots of a wood thrush become larger and darker. The breast of the white-throated sparrow becomes slate-colored and the entire bird is abnormally dark. The feathers of the Inca dove become black-edged, and the bird passes through a stage resembling the normal scaly dove to a dark condition which is unknown in nature. It has been generally recognized that birds are darkest in humid regions and palest in arid regions, thus forming numerous subspecies.

Dr. J. A. Allen of New York showed a series of skulls of Sinaloa deer collected within a radius of twenty-five miles. They presented extraordinary variation in the premaxillary, maxillary and nasal bones, which was not correlated with age or sex. A series of skulls of peccaries showed variations in the orbital region believed to be due to parasitic insect larvae. The skulls had not been examined when fresh so that the presence of parasites was not determined. The bilateral symmetry of the modifications of the orbit led some to question their parasitic origin.

Professor B. G. Wilder of Cornell University exhibited photographs of human cerebral convolutions.

Embryology.— Dr. J. Warren of the Harvard Medical School showed a series of eighteen wax reconstructions of the pineal region in Necturus, Lacerta, and Chrysemys. In all of these forms the paraphysis develops as a median outpocketing from the roof of the brain, anterior to the pineal body. In the adult Necturus the paraphysis is a macroscopic gland-like organ, consisting of anastomosing tubules between which are sinusoidal vessels derived from the sagittal sinus. Dr. Warren's models of the developing and adult paraphysis in Necturus have been described in the *American Journal of Anatomy*, 1905, vol. 5, pp. 1–28. His study of the paraphysis in reptilian embryos is not yet complete.

Professor R. J. Terry of Washington University, St. Louis, exhibited a reconstruction of the pineal region in the toad fish, *Opsanus* (*Batrachus*) *tau*. The general topography of this region corresponds closely with that of selachians (*Squalus acanthias*) but the paraphysis, which is well developed in the latter, is indicated in Batrachus only by a slight irregularity in the roof of the brain.

Professor Terry showed also a wax reconstruction of the skull of a cat embryo of 23.1 mm. This model, which is beautifully constructed, is of special interest in comparison with other similar models of chondrocrania,— Professor Gaupp's model from Lacerta, Dr. Tonkoff's model from the chick, and Professor Hertwig's model from a human embryo of 8 cms.

Professor J. W. van Wijhe of the University of Groningen, Holland, has perfected a method of making embryos transparent after a deep selective staining of their cartilages with methylene blue. The resulting preparations show the cartilaginous skeleton as clearly as the familiar transparent potash-glycerine preparations reveal the bony skeleton. This new and valuable method was used in demonstrating the development of the chondrocranium of birds, twenty specimens of which were shown under two inch objectives.

Professor W. A. Locy showed the aortic arches in chick embryos injected with ink while the heart still pulsated (a method devised, we believe, by Professor Mall). The embryos were then dissected so that the fourth and pulmonary arches were clearly shown, together with the small subdivision of the latter, which is described as the fifth arch. This fifth arch was the object of the demonstration. Its small size as compared with the other arches was evident, yet in the chick it is presumably a larger vessel than in mammals.

Professor S. H. Gage of Cornell University has obtained the glycogen reaction to iodine in sections of the medullary plate of Amblystoma, and also in nerve cells and in the deep layer of the retina in young lampreys. These tissues, which were exhibited, are additional examples of the wide occurrence of glycogen, especially in embryonic tissues, which Professor Gage has already demonstrated.

Professor Wilder showed the "smallest known embryo of the manatee," — a specimen approximately an inch and a half long.

Dr. J. L. Bremer of the Harvard Medical School exhibited reconstructions of the brain, pharynx, and liver of a human embryo of 4.0 mm. The brain is of particular interest since the neuropore is still widely open. In other human embryos of similar dimensions it is nearly or quite closed. This indicates either considerable variability in the time of closure, or that this embryo is abnormal. It presents, however, no other evidence of abnormality so far as is known.

Dr. F. W. Thyng of the Harvard Medical School exhibited wax reconstructions of the pharynx, stomach, pancreas, and cervical region of a human embryo of 13.6 mm. The jugular lymph sacs were modelled, probably for the first time in a human embryo. They

correspond essentially with the jugular sacs of the pig, rabbit, and cat. Each sac apparently communicates with the veins by a remarkably small opening which was not shown in the model. Dr. Thyng exhibited also models of the dorsal and the ventral pancreas in the rabbit, cat, and pig, one model of the latter including a well developed accessory pancreas.

Professor T. G. Lee of the University of Minnesota was the first to study the implantation and early development of the Sciuromorpha, the suborder of rodents which includes squirrels, chipmunks, prairie dogs, and gophers. Representatives of the other three suborders of rodents have been studied by other investigators. The Sciuromorpha have a characteristic early development. Before the placenta has formed, the vesicle acquires a temporary uterine attachment by means of a knob-like proliferation of cells on its ventral surface. *Geomys bursarius*, the pocket gopher, which belongs to a distinct family, perforates the epithelium of the uterus and develops in the uterine connective tissue. The aperture in the epithelium does not become closed as in the guinea pig, nor plugged as in man, so that Geomys is said to differ "in certain respects from any other mammal yet described." It may be noted that in the syncytial covering of the vesicles of all the Sciuromorpha the cells divide only by amitosis. Professor Lee exhibited a few of the interesting sections from his extensive series.

Dr. M. Herzog of Chicago has studied a very young human embryo in process of implantation. The sections exhibited were similar to those figured by Dr. Peters in 1899 as "the earliest known stage of human placentation." Because of their good condition and the rarity of such early stages, they are of great interest. The material is unquestionably normal, since it was obtained from the autopsy upon an individual who was accidentally and almost instantly killed upon the street; for such material it is unusually well preserved. Dr. Herzog has completed the study of the chorion and will soon finish that of the embryonic area and its appendages. The results will probably be published in the American Journal of Anatomy.

Cytology.— Dr. F. E. Botezat of the University of Czernowitz, Austria, was the first to demonstrate the presence of taste buds in birds. They were previously known in all other classes of vertebrates. His preparations of taste buds in the hard and the soft palate of *Passer domesticus* were shown by Dr. Gudernatsch. Preparations of Vater-Pacinian and Merkel's corpuscles from the tongue of the sparrow were also shown, demonstrating the neurofibrillar net and the end plates.

Dr. J. F. Gudernatsch of the University of Czernowitz exhibited sections of taste buds in the dugong. In the back part of the tongue there are certain large glands, the ducts of which expand into cup-shaped cavities near their outlets. In one of these cups there may be two or three elevations pitted with taste buds. The taste buds also occur occasionally along the deeper portion of the ducts. There are no vallate papillae, and no taste buds are found in connection with the small form of lingual glands. In the three orders of aquatic mammals taste buds are either absent, as in Cetacea, or they are not well developed, as in the Pinnipedia and Sirenia.

Professor S. Apáthy of the University at Klausenburg, Hungary, showed three series of cytological preparations, and demonstrated some ingenious devices used in making them. The perfection of his technique, as well as the nature of the specimens, made this one of the most notable exhibits. The first series of slides was produced by an unintentional experiment on living muscle nuclei of the leech Pontobdella, and showed important features of nuclear structure. The experiment consisted in injecting corrosive sublimate between the muscle layers of the intestine, instead of into the intestinal cavity, as was intended. The introduction of the cannula caused the nuclei to be compressed at one end and stretched at the other; in this condition they were immediately fixed by the reagent. In the normal nuclei the chromatin is arranged in coarse masses or knots at the angles of the nuclear network. In the stretched nuclei the network gave place to a series of parallel fibrils without cross connections, suggesting those of mitosis, and indicating that the network of the resting nucleus may consist of bundles of interlacing but unbranched fibrils. At the same time the chromatin knots were shown to be collections of granules rather than solid masses, for they had apparently disappeared by becoming evenly distributed along the fibrils. No nuclear membrane was seen, and Professor Apáthy believes that with few exceptions, the better preserved the specimen, the less definite is the nuclear membrane. In smears, nuclei may become distorted somewhat like those exhibited.

The second series of preparations dealt with Krause's membrane, the narrow dark line which bisects the light band of striated muscle fibers. Professor Prenant at one time believed that Krause's membrane occurred only in the muscles of arthropods and vertebrates; later be found it in Pecten and Sagitta but failed, after repeated attempts, to detect it in Salpa. Professor Apáthy demonstrated it very clearly in *Salpa maxima*, and showed it in the coelenterate

Carmarina hastata. He believes that it occurs in all striated muscle fibers.

The third series of preparations was of neurofibrillae, which were shown with astonishing clearness. The coarse fibrils of the invertebrate nerve cells (from Pontobdella and Lumbricus), the finer fibrils of the young dog, and the much finer fibrils of the adult suggest that a subdivision of the fibrils accompanies the perfection of the nervous system. The presence of neurofibrils is, for Professor Apáthy, the essential feature of a nerve cell. All cells have the property of contraction and of conduction, but they are not muscle cells unless they possess myofibrillae, nor nerve cells unless they contain neurofibrillae. It remains to be determined whether the development of neurofibrillae accompanies the outgrowth of processes from the neuroblasts.

Professor R. G. Harrison of Yale University showed drawings of the nerve cell processes sent out by detached cells of the spinal cord of a tadpole. The portion removed was examined in lymph, into which the processes grew, each having at its distal end a group of slender, radiating, amoeboid branches. At times these changed their shape more rapidly than could be drawn. Sections showing similar terminal branches were exhibited. In embryos from which the neural crest had been removed, nerves without sheath cells were produced, thus proving that nerve fibers may grow without the participation of sheath cells, and that the latter are derived chiefly from the neural crest.

Professor H. V. Neal of Knox College, Illinois, showed preparations of embryos of Squalus, demonstrating the outgrowth of processes from the neuroblasts. These processes could be traced for some distance through the surrounding tissue which took no part in the formation of the nerve fiber. The specimens showed indications of neurofibrils at an early stage.

Professor A. Maximow of the Imperial Medical Academy of St. Petersburg exhibited preparations of rabbit embryos to show the formation of the blood corpuscles. In the area vasculosa of a rabbit of $8\frac{1}{2}$ days, only one form of corpuscle occurs; it is known as the primitive blood cell, and gives rise both to lymphocytes and to primary erythrocytes. These two forms of corpuscles are all that occur in the wall of the yolk sac at $9\frac{1}{2}$ days. The primary erythrocytes are large cells derived from those which constitute the blood islands. Their formation soon ceases, and they gradually disappear from the circulating blood, in which only few remain at 20 days. Thus they are a purely embryonic type of corpuscle. The lymphocytes likewise

first appear in the yolk sac, but later they are formed from the endothelium of blood vessels within the embryo. A section of the aorta of a rabbit of 10 days and 5 hours showed a rounded mass of lymphocytes projecting into its lumen and still connected with its endothelium. The lymphocytes give rise to other lymphocytes and to the permanent erythrocytes. The latter are smaller than the primary erythrocytes; they are formed from lymphocytes throughout life, and ultimately, by the extrusion of their nuclei, they become the red corpuscles. In the vessels of the yolk sac at 12 days there are three kinds of corpuscles, namely primary erythrocytes, lymphocytes, and permanent erythrocytes. In the mesenchyma around the medullary tube of the embryo of 12 days, two small wandering cells were shown. These cells arise in the mesenchyma; in the bone marrow they come from cells like lymphocytes in the periosteal mesenchyma. The giant cells of the marrow were classed with the lymphocyte series.

In addition to these preparations Professor Maximow showed two others of much interest. One of these was a section of the thymus of a rabbit embryo of 15 days. The solid epithelial masses were being invaded by lymphocytes; the epithelial cells were not becoming deceptively similar to lymphocytes as has recently been stated. The other preparation was from a rabbit's kidney which had become atrophic, following the ligation of the renal vessels. In the kidney calcification and bone formation had occurred, and a well defined macroscopic area of bone marrow had developed. The remarkable development of bone marrow in the kidney always occurred in rabbits, but never in other animals similarly treated.

Mme. W. Dantchakoff of St. Petersburg demonstrated the formation of the blood corpuscles in the chick. A section from an embryo incubated 68 hours, showed cells similar to lymphocytes both within and outside the vessels overlying the yolk. The endothelium seemed to have formed among cells of one sort; those inside the vessels become lymphocytes and red corpuscles, and those outside become polymorphonuclear leucocytes. The differentiation of the cells was shown in a specimen of 104 hours incubation, in which eosinophilic granules were clearly seen in the cells outside of the vessel walls. A distinction between primary and permanent erythrocytes was not established by Dr. Dantchakoff in the chick. Other features, including the proliferation of endothelial cells of the aorta (shown in a specimen of 72 hours incubation), agreed essentially with Professor Maximow's demonstration of the rabbit.

Miss K. Bonnevie, of Christiana, Norway, exhibited preparations

illustrating the nature of heterotypical mitosis and showing that its significance in reduction divisions has been overestimated. Heterotypical chromosomes were demonstrated in the first cleavage division of Nereis. In the second maturation division of Amphiuma and in the first cleavage of Thalassema, cross-shaped chromosomes were shown. Cross-shaped chromosomes or tetrads are therefore not limited in Thalassema to the first reduction division. The tetrad shape was shown in some of the chromosomes of Nereis in metaphase fifteen hours after fertilization. A longitudinal splitting of the daughter chromosomes was shown in a cleavage mitosis of Nereis and also in its second maturation mitosis. Other features of chromosome structure which were demonstrated, include the spiral coiling of chromosomes in Amphiuma and Ascaris, and a spiral chromatic thread wound around the surface of each chromosome in the root tip of Allium. The relation of chromosomes to the resting nucleus was illustrated, and new chromosomes were said to arise within the disseminated chromatic material of the old ones.

Miss A. M. Lutz of Cold Spring Harbor showed sections of the root tips of *Oenothera lamarckiana*, its mutants and hybrids, to demonstrate the variations in the number of somatic chromosomes. The material appears very favorable for the counting of chromosomes, and it was remarkably well preserved and clearly stained. Nevertheless the question of one chromosome more or less in a given count is sometimes very difficult to determine. To the counts which have been made and were demonstrated by Miss Lutz, those recently published by R. R. Gates from somatic cells of the flowers may be added; their counts are as follows,— *Oenothera lamarckiana*, pure bred, 14 chromosomes (14, Gates); *O. nanella*, 14 in some plants, in others probably 15; *O. rubrinervis*, open pollinated, 14; *O. lata*, 14 in one plant, 15 in another (14 with "no indication whatever that the number is ever higher," Gates); *O. gigas*, 28 with a suggestion of a 29th in several instances, but 29 were never demonstrated in pure bred tissue; *O. lata* (hybrid) ♀ × *O. gigas* (pure) ♂ showed 21 in one plant, 22 or 23 in another, and 28 or 29 in a third. In the last case, if each parent supplied one half of its normal number of chromosomes, 21 or 22 should occur in the hybrid and this was observed in two of the plants. In hybrids produced by pollinating *O. lata* with *O. lamarckiana*, Gates has found 20 or 21 chromosomes. From these interesting studies which are still in progress it appears that *O. lamarckiana* and most of its mutants usually possess 14 somatic chromosomes; that *O gigas* has double that number, suggesting a variety like *Ascaris*

megalocephala bivalens; and that in the hybrids there may be an extraordinary disturbance in the number of chromosomes, the laws and the explanation for which are not apparent.

Methods and Publications.— Dr. R. M. Yerkes of Harvard University exhibited apparatus for testing color vision and the delicacy of visual discrimination in mice. Similar boxes are illuminated either by photometered lamps of different intensity or by colored lights. Over the floors of the boxes are wires for an interrupted electric current whereby the animal receives slight shocks when it enters the wrong box. The value of the apparatus is in its complete elimination of sensations other than those which are being tested. Under the title "The dancing mouse; a study in animal behavior," the MacMillan Company has in press a collected account of Dr. Yerkes' investigations of the mental life of a lower mammal.

Mrs. S. P. Gage of Ithaca, New York, showed her method of making models from sheets of blotting paper instead of plates of wax. The outline of the section is drawn upon the paper and may be cut out by the needle punctures from an unthreaded sewing machine. The blotting paper is then soaked in melted paraffin, and the smoothing of the surface, after the model has been put together, is done with paraffin. Pins are inserted, as in wax models, for stability. The resulting model is light and less fragile than those made of wax; it is not liable to change its shape in warm weather, or to crack by the expansion of metal supports.

Professor G. A. Drew of the University of Maine showed a method of making a series of anatomical drawings for reproduction by the zinc process. That part of the animal which is to appear in several drawings is drawn first, and photographed upon suitable paper. The figure is then completed by using pen and ink upon the photograph. Thus the organs may be drawn and photographed, and four figures of the nerves, arteries, veins, and lymphatics respectively may be built up upon this background. Professor Drew used the method in making his drawings of Pecten.

Dr. H. H. Field of Zürich exhibited a complete series of the card index to biological literature, issued by the Concilium Bibliographicum. It was shown properly arranged in a library cabinet, and its system was fully explained.

The Department of Comparative Anatomy at the Harvard Medical School exhibited a portion of its collection of 1188 series of vertebrate embryos, sectioned by the paraffin method. This collection may be used at the school by any visiting scientist.

The Secretary of the Universidad Nacional de Buenos Aires sent to the congress numerous photographs of its zoological gardens.

Professor W. B. Scott of Princeton University exhibited Vols. 1, 4, 5, and 8 of the Reports of the Princeton University Expeditions to Patagonia. These volumes, which are all that are now published, are devoted to the general narrative, botany, and paleontology. The entire work is expected to require fifteen volumes, and the expense of publication is met by the "J. P. Morgan Publication Fund." The narrative is said to compare in interest with Darwin's account of the voyage of the Beagle, and it may be printed in brief form for more general distribution.

Dr. H. Przibram of the University of Vienna showed copies of his *Einleitung in die experimentelle Morphologie der Tiere* published by F. Deuticke, Leipzig und Wien, 1904, and the *Experimental-Zoologie, 1, Embryogenese,* published by the same firm in 1907.

Dr. M. C. Piepers sent to the congress a copy of his book *Noch einmal, Mimicry, Selektion, Darwinismus,* published by E. J. Brill, Leiden, 1907. His earlier publication upon the same subject contained the theses which he presented to the Fifth International Zoological Congress, at Berlin, 1901.

Variation and Mendelism.— Professor W. Bateson of the University of Cambridge, England, whose address on "Facts limiting the theory of heredity" was of unusual interest, showed the great variation occurring in certain moths, and the results of cross-breeding in pigeons, poultry, and corn. Since this exhibit was not unpacked until the close of the congress, it could not receive the attention which it merited.

Professor T. Dwight of the Harvard Medical School invited the congress to inspect his very fine collection of variations in human bones, displayed in the Warren Museum.

Professor W. E. Castle of Harvard University exhibited live rabbits, guinea pigs, and rats, showing in a most effective way several forms of inheritance. The animals were exhibited in Cambridge, where breeding experiments are still being conducted on an extensive scale. The first series showed color varieties of the domesticated rabbit. The wild gray rabbit bears three independent heredity units,— one for black, one for yellow, and a third for barring (which causes the black and yellow to be disposed in bands upon the individual hairs). The various known color varieties result from the loss or modification of one or more of these three units. The inheritance is Mendelian. The unit composition of each known color variety was explained and in some cases demonstrated by the results of breeding experiments.

It was shown, for example, that in the absence of the barring factor, the black and yellow factors combine to produce three color varieties,— namely pure black, if the black factor is in excess; sooty yellow, if the yellow is in excess; and blue, if the black factor is modified and dilute and the yellow is scanty. Albino animals possess the color factors, but lack an activating substance necessary for pigmentation; the albino form may occur in any of the color varieties.

The second series showed color varieties of the guinea pig. As in the rabbit, the wild coat contains black, yellow, and barring factors which are inherited as independent units. There is also a separable brown factor which in the absence of the black and barring elements produces chocolate colored animals.

The third of the series exhibited was from a race of guinea pigs having four-toed hind feet. The hind feet of the guinea pig, agouti, and capybara are normally three-toed; those of rabbits are four-toed and of mice five-toed. By unremitting selection from the progeny of a single four-toed 'sport,' through five generations, a corresponding race of guinea pigs has become established. The effects of selection upon the color pattern (spots) of guinea pigs and rats were demonstrated, and the last series showed the blended inheritance of ear-length in rabbits. The offspring of a long-eared and a short-eared rabbit have ears of intermediate length, and breed true.

F. T. L.

ZOOLOGY

The Families and Genera of Bats.— One of the most important recent contributions to the taxonomy of the Chiroptera is "The Families and Genera of Bats," by Gerrit S. Miller, Jr., forming Bulletin 57 of the United States National Museum. It is a volume of about 300 pages, with 14 plates and 49 text cuts, illustrating the dentition, cranial and skeletal characters of this diversified order. The first 12 pages of the introduction are devoted to the technical history of the group, from Linnaeus (1758) to Weber (1904). This is followed by 30 pages on the anatomy of bats, relating especially to the structure of the wing, the shoulder girdle, and teeth, and by a systematic review of the genera and higher groups. The order Chiroptera is divided into the usually recognized two suborders, Megachiroptera and Microchiroptera, the former consisting of the single family Pteropidae,